How can we reduce information asymmetries and enhance trust in 'The Market for Lemons'?

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Abstract: The used car market is characterized by information asymmetries and mistrust. Blockchain technology promises to resolve these problems using a system which stores data over the life cycle of a vehicle. However, while blockchain technology is strong in preserving the stored information, sense-making of this information is still essential to bring value to end consumers of the system. In this paper, we take an exploratory approach and create a prototype, which is then evaluated in realistic car sale conversations between buyers and sellers. We demonstrate and discuss how the interplay of different design elements of an application, built on top of a blockchain-based platform, helps to reduce information asymmetries and enhance trust. Our findings suggest that though providing more information about a used product (a car) leads to fewer information asymmetries in general, a reputation mechanism and data analysis are both beneficial in improving the situation further. As for trust, such a system enhances trust between buyers and sellers and, in general, makes the overall purchase process more trustworthy. However, to achieve these positive effects, the quality of the stored information should be guaranteed and properly communicated to the end-user.

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HOW CAN WE REDUCE INFORMATION ASYMMETRIES AND ENHANCE TRUST IN 'THE MARKET FOR LEMONS'?

The used car market is characterized by information asymmetries and mistrust. Blockchain technology promises to resolve these problems using a system which stores data over the life cycle of a vehicle. However, while blockchain technology is strong in preserving the stored information, sense-making of this information is still essential to bring value to end consumers of the system. In this paper, we take an exploratory approach and create a prototype, which is then evaluated in realistic car sale conversations between buyers and sellers. We demonstrate and discuss how the interplay of different design elements of an application, built on top of a blockchain-based platform, helps to reduce information asymmetries and enhance trust. Our findings suggest that though providing more information about a used product (a car) leads to fewer information asymmetries in general, a reputation mechanism and data analysis are both beneficial in improving the situation further. As for trust, such a system enhances trust between buyers and sellers and, in general, makes the overall purchase process more trustworthy. However, to achieve these positive effects, the quality of the stored information should be guaranteed and properly communicated to the end-user.

1 Introduction

Mistrust and uncertainty rule automobile markets all over the world. Notably, the market for used cars is deeply affected by these issues. The lack of trust in this market has a long history: In the 1970s, Nobel Prize winner G. A. Akerlof offered insight into why the used car market is characterized by massive distrust, in his noted work "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism" (Akerlof 1970). He found that the main reason lies in the fact that while the sellers have good knowledge about the quality of the car being sold, the buyers are left in the dark - hence the uncertainty. Since sellers are aware of this effect, they will try and sell their car for a price that is too high in relation to the quality of the specific car. This information asymmetry creates opportunistic behavior, which results in mistrust between buyers and sellers and can even lead to a complete market failure. These characteristics still exist in the modern used car market; it is still haunted by information asymmetries, distrust and uncertainty.

In a novel approach to tackle these issues, a Swiss blockchain-based electronic platform project named "Cardossier" has commenced. The project was initiated by a several organizations from the car-related ecosystem (an insurance company, a car sharing company, an importer and car dealer, and a road traffic agency), a software company, and two universities[1]. This platform aims to store and exchange the complete information about the life cycle of a car, from production to disposal. The idea is that by storing as much information as possible about the car's history, the information asymmetries can be reduced, as well as potentially ensuring the trust between buyers and sellers. Instead of a conventional database for data storage, the participants of the project opted for usage of permissioned blockchain system (participants know each other), which due to its characteristics (such as immutability of transactions, transparency, integrity of data, and decentralized character (Seebacher and Schüritz 2017)) claims to bring more trust in relationship of transacting parties (Fleischmann and Ivens 2019). The participating organizations leverage the technology to benefit in three ways: Shared operational efficiency, controlled customer intimacy, and joint product innovation (more on this aspect can be found in Bauer et al. 2019). Why blockchain? This choice was determined by several reasons. First, the participants of the project (public and private organizations from the car-related ecosystem) did not want to rely on one single provider (be it one from the ecosystem, e.g. an insurance company, or an external like Amazon or Google) to run the system for them and, thus, give away the steering powers. Second, a distributed platform allows to comply to strict EU data privacy regulations. In this study, we propose a design for an interface application to the cardossier platform to reduce information asymmetries and improve trust between used car buyers and sellers.

However, just storing the information life cycle of the car is not enough. There must be business logic applied in order to present the information in such a way that involved parties can make educated decisions about the quality of a car, or whether a party is trustworthy or not. To solve the problem of information asymmetry, sellers - and especially buyers - have to be informed about the actual quality and condition of the car. Though underlying blockchain technology is strong in preserving the stored information (by immutability of stored records or data), sense-making of this information is still required to bring value to the end consumers in the system. For this, research must be conducted to establish the kind of information buyers and sellers are looking for and how it

[1] In March 2019, a non-profit association was founded to prepare market entry and expand the ecosystem. Ten new organizations joined the project by July 2019.

should be presented to them to solve the problems of existing information asymmetries and mistrust in the used car market. Thus, we state the research questions as follows:

RQ1: How can the provision of car usage data in a blockchain platform reduce information asymmetries and enhance trust in the used car market?

RQ2: How can further relational data be included to reduce information asymmetries and enhance trust in the used car market?

Consequently, the two main research objectives are to propose a design for reduction of the information asymmetries between buyers and sellers of used cars as well as for enhancement of their trust to each other by provision of car usage information as well as additional relational data. We recognize that this study takes an exploratory approach and aims to propose initial design ideas and explore their potential, rather than proposing a mature design theory. Furthermore, though there are other perspectives that play an important role in the design of such a platform (for example, its governance (Ziolkowski et al. 2019), business value for participating companies (Bauer, Zavolokina, Leisibach, et al. 2019), data privacy (Zavolokina et al. 2019)), in this study we focus on the perspective of an end user, who interacts with the frontend application and does not deal with the blockchain-based backend.

On the example of the used car market, this study contributes confirmation of positive influence of blockchain application on reduction of information asymmetries and trust enhancement in the used car market, design ideas and their evaluation to the question of *how* information asymmetries between buyer and seller can be decreased, and their trust enhanced. For researchers, this study provides a foundation for further research on the role of trust in IT artifacts in the context of used car market, reputation mechanisms and the design of applications on top of blockchain technology. For practitioners, this work offers a practical view on the implementation of design components suggested in this study. Insights concerning the importance of data quality over data quantity are given, which is something a blockchain-based car data platform should incorporate.

In this paper, we first introduce the *research design* and then describe the activities of design science research methodology (DSRM) by Peffers et al. (2007), performed in this study. These activities inspire the structure of this paper. In the section *Literature Review*, we initially *identify problems & objectives*. Then, we define the *solution*. Afterwards, the *design & development* of the IT artifact is presented, followed by *demonstration &*

evaluation of its use in an experimental setting. We then *discuss* our results and draw *conclusions*. The paper closes by outlining *limitations* of our study.

2 Research Design

In this study, we follow a Design Science Research (DSR) approach, which aims to develop new knowledge about artifacts that contribute to the body of academic knowledge or prove to be useful in practical applications (Gregor and Hevner 2013; Hevner et al. 2004; Nunamaker et al. 2015). We create an IT artifact for a proof-of-concept research stage. One of the key goals of proof-of-concept stage is 'to demonstrate the functional feasibility for a potential solution to an important class of unsolved problems in the field.' (Nunamaker et al. 2015). Proof-of-concept prototypes are often simplistic but have enough functionality for testing their functional feasibility (Nunamaker et al. 2015). This goal inspires our research. Proof-of-concept prototypes have higher risk of failure, but are useful for laying a foundation for next stages in research (i.e., proof-of-value followed by proof-of-use) and quicker provision of deeper and richer insights (Nunamaker et al. 2015). The created IT artifact in our study is an instantiation (March and Smith 1995), based on research on 'The Market for Lemons', trust and reputation mechanism. As a research paradigm, DSR is widely accepted among information systems researchers and can be used to derive generalizable knowledge from specific problems and solutions. The research approach is based on the methodology of Peffers et al. (2007). Peffers et al. (2007) established the DSRM, a robust framework for conducting research in the area of Design Science in Information Systems. The methodology offers principles, practices and procedures which are helpful in carrying out such research. DSRM was chosen as the main methodology of this work as it is a well-grounded framework for successfully conducting DSR (Peffers et al. 2007). DSRM consists of six activities in a nominal sequence (Peffers et al. 2007): (1) problem identification and motivation, (2) definition of the objectives for a solution, (3) design and development, (4) demonstration, (5) evaluation and (6) communication. These activities are used to structure this study. In this work, a problem-centered approach is taken because the lack of trust and uncertainty plague the used car market. Thus, there is a need for an efficient solution that solves these issues.

The framework was applied in this work as follows: Starting with a problem-centered approach, activities 1 to 5 were executed. DSRM is an iterative process and may result in several iterations between activities 2 and 6. In this study, we made a second iteration through activities 3 to 5, integrating outcomes of the design and demonstration from the first iteration. All these activities are described in more detail in the subsequent sections of the paper.

3 Literature review

3.1 Identify Problems and Objectives

The specific research problem should be defined, and the value of a solution should be justified. To identify the problems and the motivation for the study, a standard backward and forward search (Levy and Ellis 2006) of literature about the used car market, information asymmetries, trust, reputation and blockchain was conducted. Based on the results of the literature search, a precise problem statement was defined, and a solution to the problem was both justified and clear in its motivation. In our study, we examine two closely connected problems that are present in the 'lemon' market: (1) The presence of *information asymmetries*, and (2) The *missing trust* between buyers and sellers of used cars. Based on the problem definition, objectives for a solution should be inferred (Peffers et al. 2007).

Most buyer-seller relationships, such as those in the used car market, are characterized by information asymmetry (Ba and Pavlou 2002). This is based on the fact that the seller usually has more information than the buyer about the quality of the product or the service (Ba and Pavlou 2002; Mishra et al. 1998). Only after owning a specific car for a while can the buyer form a good idea of its actual quality, which is more accurate than the original estimate (Akerlof 1970). Furthermore, the information asymmetry may give rise to opportunism (Akerlof 1970). Ba and Pavlou (2002) define opportunistic behavior as "self-interest seeking with guile". In other words, the informed seller tries to cheat the uninformed buyer in the hope of securing a higher sale price. This can happen through misrepresentation of the true condition of a car, incomplete disclosure of information, actual quality cheating, contract default, failure to acknowledge warranties, or other ways (Ba and Pavlou 2002; Mishra et al. 1998). Akerlof (1970) explains that this opportunism can potentially lead to a full market failure: As the buyer cannot differentiate "good cars" from "bad cars", most traded cars will be 'lemons', as these have the potential to earn sellers the greatest profit. Consequently, the "bad cars" tend to drive out the "good cars", as they will sell at the same price.

If both uncertainty and incomplete product information (information asymmetry) are present in a transaction, trust becomes critical (Ba and Pavlou 2002; Swan and Nolan 1985). In the used car market, both of these factors are present. The buyer does not have full information about the quality of a car and often does not know the seller, which creates uncertainty. Additionally, the buyer is aware of these relationships, which makes him wary of the

seller. Finally, both the buyer and the seller, have a motivation to complete the sale with a low and respectively high price, which creates an underlying major conflict of interest. Together, all these factors and effects lead to significant distrust between the two parties.

Research has shown that creating a design for trust is not a trivial task and involves thorough understanding of trust concepts. Even though the concept of trust is easy to recognize, as we experience it daily, it manifests itself in various forms which makes it difficult to describe (Jøsang et al. 2007; McKnight and Chervany 1996). The term "trust" can be defined as "the willingness of a trustor to be vulnerable to the actions of a trustee based on the expectation that the trustee will perform a particular action important to the trustor, irrespective of the ability to monitor or control the trustee" (Mayer et al. 1995; Söllner and Leimeister 2013). Per the definition, trust is a relationship between a trustor and a trustee. The trustor chooses to make himself vulnerable by trusting the actions of a trustee. They cannot control what actions the trustee will take: The trustee can either honor the trust and act in the trustor's interests, or they can abandon the trust and abuse it. While the trustor is generally understood to be a human, different categories of trustee exist: human beings, organizations, institutions and IT artifacts (Söllner and Leimeister 2013). IT artifacts usually take the mediator role (supporting the relationship between trustor and trustee), but they can also take the role of a trustee. In this study, we look how an IT artifact may be designed to influence the trust of humans in other humans (IT artifact in the role of a mediator in trust relationships between buyers and sellers). For this, an understanding of the formation of trust is crucial. Most researchers adopted the model of Mayer et al. (1995) and its three dimensions of trustworthiness. In the model, trust between humans is assessed based on the trustee's ability, benevolence and integrity (Söllner and Leimeister 2013). *Ability* refers to the trustor's perception that the trustee has the skills, competencies and characteristics that enable him to have influence in a specific domain. *Benevolence* reflects the trustor's perception that the trustee wants to "do good" for the trustor and does not follow an egocentric profit move. *Integrity* reflects the trustor's perception that the trustee has a set of principles and rules that they adhere to, which will be acceptable to the trustor. We adopted these constituents of trust when constructing the surveys used to evaluate the designed IT artifact in the role of a mediator for the inter-personal trust relationship.

Since IT may help in the reduction of information asymmetries and the improvement of trust, our initial objective is to design a system which positively influence these aspects. In order to formalize the designed solution, a rigorous literature review has been conducted. This literature review takes a closer look at the creation of market transparency as a means of: reducing information asymmetries, enhancing trust, and designing such systems on

top of blockchain platforms. Furthermore, we examine how provision of relational data (product-related as well as person-related) may be designed to attain the goals. Table 1 gives an overview of the objectives of the proposed solution discussed above, and components of the proposed solution discussed below.

3.2 Define Solution

Increasing market transparency could help in reduction of information asymmetries (Rezabakhsh et al. 2006). Market transparency can be defined as the "level of availability and accessibility of information about products and market prices" (Granados et al. 2008). Companies use IT to improve and automate their selling mechanisms with informational features. Thus, IT increases the potential for complete, accurate, and unbiased market information (Granados et al. 2006). In this context, market transparency refers to two types of information: product information and price information; both are important drivers of a consumer's purchase decision. Therefore, it's necessary to provide transparency over both types of information. *Product transparency* refers to disclosure of product attributes and quality information, while *price transparency* refers to more and better information about market prices and market dynamics. Therefore, both of these dimensions lead to a more transparent market for consumers (Granados et al. 2006, 2008).

To reduce the information asymmetries, relevant information must be provided to both parties. The lack of trust, on the other hand, is harder to mitigate, as it is rooted in a complex mechanism and is different for every party (Söllner and Leimeister 2013). *Reputation* mechanisms provide one way to improve trust and such mechanisms have been successfully applied in the past (Fuller et al. 2007). Thus, *transparency over one's reputation* should be provided to enhance trust. We use reputation mechanism to reflect person-related data. Using reputation, sellers of low-quality cars achieve lower prices, which in turn results in a healthier market with a variety of quality and prices (Resnick et al. 2000). Additionally, it allows for sellers with favorable reputations to achieve an improvement in revenue, as buyers may be willing to pay extra for the security and comfort of their services (Resnick et al. 2000). Reputation transferability (which allows for transfer of a reputation score from one platform to another) between different platforms can further reduce uncertainty and develop the trust of customers (Kokkodis and Ipeirotis 2015). In their extensive study, Fuller et al. (2007) investigated whether reputation, in the form of external information, would positively affect a user's trusting beliefs (which in turn results in trust). Fuller et al. (2007) conducted a large experiment (N = 369) and examined how reputation information influences consumer decision making in an e-vendor environment. They found that reputation information that focuses on

ability (called *competence* in their study), benevolence and integrity directly affects a buyer's trusting beliefs regarding the ability, benevolence and integrity of the seller, with significant results for each of the different criteria. Therefore, in our study, we investigate if and how reputation mechanisms may foster trust between buyers and sellers and make the sales process more trustworthy.

Previous research has shown that blockchain technology can be an appropriate basis for a solution to resolve information asymmetries and trust issues in the used car market by creating a blockchain-based vehicle history (Bauer, Zavolokina, Leisibach, et al. 2019; Brousmiche et al. 2018; Notheisen et al. 2017; Zavolokina et al. 2019). The main benefits that blockchain technology brings are authentication of data and transactions stored in a blockchain ledger (Miscione et al. 2018), and resulting out of it trust (Fleischmann and Ivens 2019). A blockchain-based vehicle history is an alternative solution to traditional vehicle history reports, like ones offered by Carfax or car manufacturers. Today, traditional vehicle history reports have several shortcomings which can be resolved by blockchain technology. These shortcomings include lack of trust of end users in the single data source, strong control over the data from one single data provider, low data quality (due to its incompleteness and incorrectness), no proof of authenticity of the provided data, and finally high costs. In blockchain-based solutions, car-related data is collected from and validated by various organizations involved in the life cycle of a car. Often, such solutions are based on permissioned blockchains, where participants are known, which makes the overall system more transparent and trustworthy. Storing data in a blockchain-based system makes this data immutable, data providers transparent, and overall control over the system distributed between its participants. Blockchain technology cannot be the holy grail to resolve all of the mentioned shortcomings. However, it provides a possibility to create and access a more secure, reliable, and thus, more *trusted* data in a vehicle report due to the technology's capabilities of authenticating data (Miscione et al. 2018) and distributed data collection. The value of this data was discussed in several studies. Simulating an online used car marketplace, we could demonstrate a positive impact of the trusted car data both for buyers and sellers in the used car market from the market perspective (Bauer, Zavolokina, and Schwabe 2019). Furthermore, business value for involved organizations was identified as such: organizations benefit in the areas of shared operational efficiency, joint product innovation, and controlled customer intimacy (Bauer, Zavolokina, Leisibach, et al. 2019). All these values are enabled by access to trusted, blockchain-based car data. Furthermore, usage of blockchain technology for such an application enables to manage digital rights for data ownership, storage, usage, access provision (Zavolokina et al. 2020). In the study at hand, we examine the user perspective on a blockchain-based history report being used in a face-to-face sales situation.

While most recent studies focused on the technical aspects of blockchain systems, only a few focused on the user's perspective and actual application design. Zavolokina et al. (2019) formulated generic requirements for such a system to support used-car buyers experiencing uncertainty when purchasing a car and searching for information about its quality. These requirements include: *data analysis* (the analysis of stored raw data to make sense of it), provision of a *timeline* of a vehicle's life cycle with event records, *independent parties'/experts' evaluation*. We use data analysis and evaluation from independent parties as the product-related data. However, the value of these requirements has not yet been proven. In our study, we adopt these requirements, show how they may be incorporated in the design of the system, and reflect on their usefulness in reducing information asymmetries and their influence on trust relationships. We do not fully focus on the technical capabilities offered by the underlying architecture of blockchain technology, but rather on an application enabled by the technology. Therefore, the discussion of blockchain technology here, and further in the paper, is limited to core concepts.

Objectives of a solution	**Solution**
- Reduction of information asymmetries and trust enhancement through provision of car usage data	- Basic car data - Timeline of a car's life cycle (Zavolokina et al. 2019)
- Reduction of information asymmetries and trust enhancement through provision of further relational data	- Product-related data (independent parties'/experts' evaluation, data analysis (Zavolokina et al. 2019)) - Person-related data (reputation mechanism (Fuller et al. 2007))

Table 1 Objectives and the proposed solution

4 Design and Development

The designed and developed artifact is a prototype for the interface application, developed to utilize and demonstrate data in the dossier about a specific car, available on the cardossier platform, to the end user (a car buyer or a car seller). The artifact is a prototype that accompanies development activities in the overall cardossier project. Figure 1 illustrates the architecture of the cardossier platform. Cardossier Core is a blockchain-based storage for data exchange (in our case, based on Corda blockchain). The cardossier Dapp store allows to develop

decentralized applications (so-called Dapps), which utilize the stored car-related data to execute business logic (for example, to create an insurance police, for fleet management, or other use cases). These Dapps, in their turn, are then connected to external systems, such as web portals (for example, an online portal for used cars), web applications, or core systems of the consortium partners. In this study, we focus (marked as purple on Figure 1) on the design of the interface application (and its business logic provided by the Dapp) that encompasses the dossier of a car to support the end users, used car buyers and sellers. We further refer to this prototype for the interface application as cardossier.

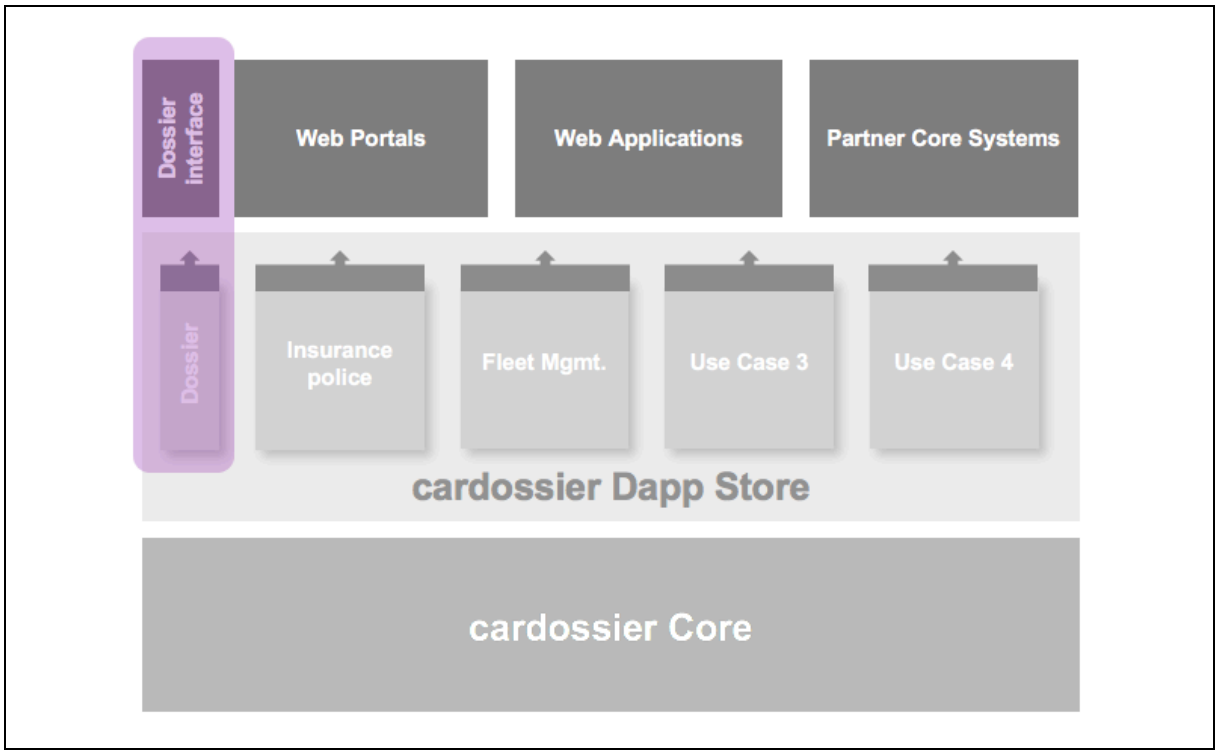

Figure 1 Architecture of the cardossier platform

This section introduces the artifact's desired functionality, its architecture and its actual creation. The design process has undergone several iterations, and this chapter focuses on the final design prototype and explains its various components. An important design decision was made at an early stage: The targeted devices for the prototype were smartphones of all kinds. The reason for this was that the prototype should be able to support both the buyer and the seller at the point of sale. A laptop or a desktop computer was not considered suitable for this purpose, so the logical option was to design either a tablet or smartphone-based solution. As smartphones are considerably more popular than tablets and also more practical – they are small and do not rely on wi-fi connectivity, the decision was made to design a smartphone-based solution. In order to increase accessibility, it was decided that a web-based application would be developed.

Further, we provide a description of the frontend component of the prototype. In total, we propose six design components, which we then explore in relation to the objectives of the solution and the stated problems. We relate design components 1 – 5 to the provision of market transparency (by targeting both product and price transparency), enabling the reduction of information asymmetries. Design component 6, in turn, relates to the provision of transparency over one's reputation, leading to enhanced trust. We recognize that these components should complement one another to maximize the benefits. We further describe the proposed design components in a solution scenario. As illustrated in more detail below, there were two versions of the prototype which included different design components. In the scenario, we describe all integrated design components to give a complete overview (corresponding to the Complete Prototype). Screenshots of the six design components integrated into the prototype (in Figures 2 – 7) provide visual support for the description. We describe only one scenario: when the seller and the buyer meet, and the car purchase and examination take place offline. However, alternative scenarios (e.g. the buyer examining the cardossier online before or after the meeting) are possible.

Protagonists: Max (Buyer), Cassandra (Seller)

Max, a 26-year-old Swiss male from Zurich, recently graduated from the university. He was then offered a job at a Swiss software company located 100 kilometers outside of Zurich. To travel to his job on a daily basis, he decided to buy a car which he planned to use for commuting. As his budget was small, he opted to buy a used car. Max searched on an online platform for a 6-year-old VW Golf. All results showed prices and different information about the cars, and result showed varying amounts of data. He found a car which was reasonably priced and felt that the car would perfectly suit his needs. He used a form on the website to ask the car seller, Cassandra, whether this information was true and asked to meet for a conversation about the purchase. A couple of days later, they met in the city.

While meeting Cassandra, Max went to the cardossier.com website and checked the cardossier for the Cassandra's car by providing its VIN[2]. Max explored the cardossier:

(1) Basic information (see screenshots in Figure 2 and Figure 3) First, Max saw the basic information about the car: The car's key figures, which included its date of first registration, mileage, number of previous owners

2 A vehicle identification number (VIN) is a unique code, including a serial number, used by the automotive industry to identify individual motor vehicles, towed vehicles, motorcycles, scooters and mopeds.

and vehicle class. He carefully examined the mileage information and compared it to the information provided by Cassandra. He knew that mileage is quite often manipulated. In the cardossier, he saw the graph showing how the mileage status was developing over time compared to the average mileage for this specific car model. The next section he scrolled to was titled "care". This section gave more information about how the car was cared for. This included warranty, smoking, car examination and service information. Next, was a safety section that listed any accidents and recalls the car might have experienced.

(2) Car timeline (see screenshot on Figure 4) Directly afterwards, Max saw a timeline of the car's life. He was surprised that he could trace the entire history of the car back to its production. He could click through the different years and the cardossier showed him the events for each selected year. The items in the timeline contained information about events in the car's life, such as accidents, mileage changes, car examinations, services or owner changes. Each of the events consisted of an event title, a free text field giving detailed information about the event, an event date, and information about the data source of this particular event. He found out that the car had been involved in an accident, which Cassandra did not mention. Max asked Cassandra questions about facts from the timeline and observed her reactions to his questions.

(3) Evaluation of car quality (see screenshot on Figure 5) Max had seen some facts in the data. However, he was not sure if these facts necessarily meant the car was of good quality or bad quality. When he found the section with reviews and ratings provided by an independent, third-party car expert and reviews by previous potential buyers who inspected the car (but did not buy it), he was surprised by the availability of such information about the car. A rating consisted of stars (ranging from 1 to 5, where 1 = worst and 5 = best; half stars were possible), a title, a free text field and additionally positive and negative comments. The stars, title and free text made up the general part, while the positive and negative items made up the specific part. He saw that the expert provided a 5-star rating and that he confirmed and explained some facts (age, number of owners).

(4) Articles On the next tab, Max saw some relevant articles (reviews by car magazines or tests by car experts) as well as videos for the car's model. These articles and videos were related to the general model, not the specific car he was viewing. As Max didn't have much expertise in the evaluation of cars, he found this section helpful to see how cars of the same model performed.

(5) Cost prediction and life expectancy (see screenshots on Figure 6 and Figure 7) Max asked himself how long he would be able to use the car, given its quality, and how much this usage would cost him. Max could

answer these questions looking at the cardossier: there was a usage section that showcased how the car was used during its life. For this, the car's life expectancy and its expected yearly costs were shown. These were information components that were interactive (e.g., the costs widget would estimate his yearly costs if he drove that specific car). Max could then increase or decrease the default yearly predicted mileage to see how it affected the costs. In the life expectancy section, Max could look at the life expectancy of the VW Golf offered by Cassandra, compared to average cars of the same model. Although the car had had a minor accident before, he was happy to see that the predicted lifespan was longer that the average for this model.

(6) Seller's personal data and reviews Max wondered why Cassandra hadn't disclosed the information about the accident she'd had. Did she intentionally keep it from him? Did she just forget to tell him? Or didn't he even ask her? He wasn't certain he could trust her. In the cardossier, Max found information about the current owner of the car (Cassandra). This information included the name, type (private or professional seller), address, number of previous sales and average ratings of the owner. By scrolling further down, he found more detailed ratings and reviews about her as a seller in the ratings section. He saw that these ratings came from a related online auction platform, where Cassandra had already sold other smaller used items. Like earlier sections in the cardossier, it had star ratings ranging from 1 to 5, a title, free text field and positive as well as negative comments. Max was relieved to see that Cassandra had quite positive ratings and reviews.

Max felt reassured having been able to check the information on the cardossier website. He knew Cassandra couldn't influence the information, and he was able to make sense of it without relying on Cassandra's words. Therefore, he decided to buy the car.

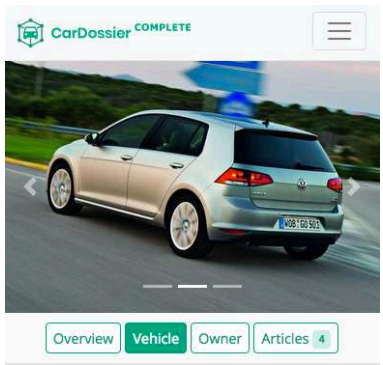

Figure 2 Basic information about the car

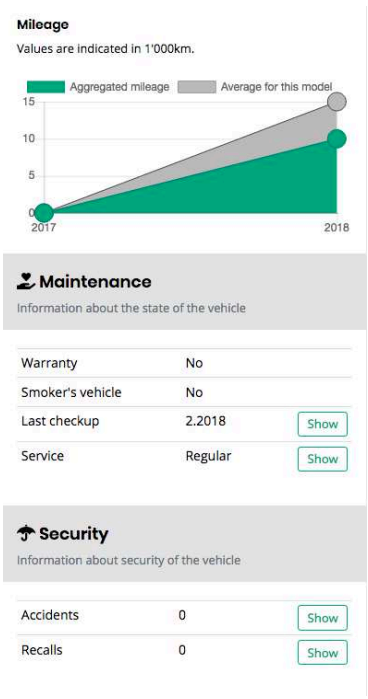

Figure 3 Basic information about the car (continued)

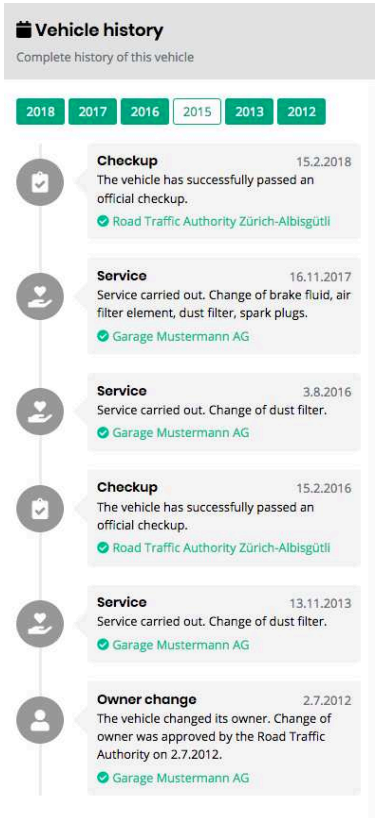

Figure 4 Car timeline

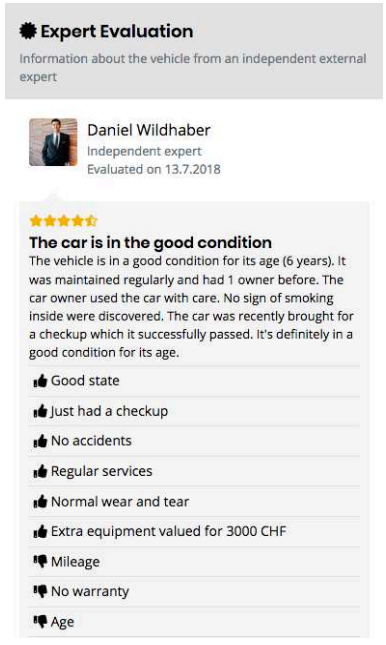

Figure 5 Expert evaluation of car quality

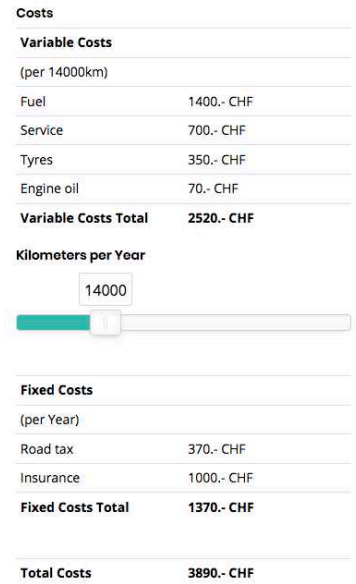

Figure 6 Cost prediction

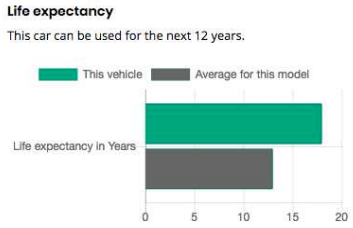

Figure 7 Life expectancy

5 Demonstration and Evaluation

5.1 Evaluation strategy

DSR suggests that the achievement of objectives and the identification and solving of problems should be evaluated. Venable et al. (2012) discuss different purposes of artifact evaluation in DSR. Our study aims at evaluating 'an instantiation of a designed artifact to establish its utility and efficacy (or lack thereof) for achieving its stated purpose'. More specifically, in our research, we aimed to reduce information asymmetries and to enhance trust between buyers and sellers in the used car market through provision of (1) car usage data, and (2) further relational data. For the evaluation of the artifact, we used the guidelines, proposed by Pries-Heje et al. (2008) and Venable et al. (2012): We evaluated a design product (the cardossier) ex-post, in an artificial evaluation using a realistic scenario of car sales conversation between a car buyer and a car seller. Venable et al. (2012) recommend a lab experiment for this evaluation. As we tested a proof-of concept prototype (Nunamaker et al. 2015), rich insights from a realistic setting are more important than statistical power ("Speed and exploratory rigor are therefore useful to produce rich understandings of how and why people respond to various early approaches [....]. Quantitative experimental rigor is less useful in proof-of-concept research" (Nunamaker et al. 2015, p. 19)). Such design research gains its power by concatenation, i.e. a series of studies that observe similar phenomena in varying contexts. In our case, the reported study is preceded by a large scale survey (Zavolokina et al. 2019) that support the identification of problems and requirements. And some of the insights presented here are supported by a later study applying experimental techniques to a larger experimental sample (Bauer, Zavolokina, and Schwabe 2019). This paper contributes the rich contextualized knowledge of a realistic experiment testing a novel artefact. Therefore, we applied not only quantitative methods (to gain indicative numbers) but also relied on qualitative methods (described in the next sub-section) that allowed us to gain a deeper understanding.

This type of an evaluation was chosen after careful considerations regarding evaluation goals and tradeoffs between richness and rigor of obtained results. We took an exploratory approach to test early design ideas for the novel cardossier application to solve the discussed problems in the used car market. Exploratory research is aimed at describing a phenomenon of interest when there is little or no scientific knowledge about it. Given the novelty of blockchain applications in general and their use in regards to trust and information asymmetries in the context of the used car market, we believe our approach is appropriate.

For the evaluation of the artifact, we used experimental techniques (Riege et al. 2009) to understand if we reached the objectives of the study, how the design ideas contribute to this goal attainment, and what practitioners can learn from the observations for the future design and development. Therefore, we did not strive for a large number of subjects, but rather for a broad variety of different techniques, both qualitative (observations, taking notes, audio recordings of sales conversations, interviews) and quantitative (survey). This approach helped us to achieve richer insights, however, has its limitations in terms of generalizability of the results. In order to gain insight about how the system may be used in the real life, the evaluation setting was made as close to the realistic situations of used-car sales as possible. For this, buyers and sellers were hired to play the roles of buying and selling a car. The evaluation compared a traditional sale scenario with a cardossier-supported one. Furthermore, as it is important for us to differentiate between "raw data" stored in the system and design components that provided aggregated or analyzed information, we split the IT-supported conversations into two, as further described in the section *Evaluation method*. To measure the goal attainment, we looked at how the perceived knowledge about the car (to meet the first objective of reducing information asymmetries) and the perceived trust of buyers in sellers (to meet the first objective of enhancing trust) change between settings.

5.2 Evaluation method

In our research, two within-subject experiments were conducted: one using a private sale scenario and one using a professional sale scenario. Both experiments used a near-realistic setting that was kept as similar as possible. In the experiments, the test persons were given scenarios and the task to either buy a car as cheaply as possible (buyers) or sell the car as profitably as possible (sellers). For both experiments, a real car was arranged for sale. This was done to make the experiments as realistic as possible, as the buyers could visually inspect the car and the sellers could talk about features and the condition of the car. Apart from a test drive, the buyers and sellers could interact with the car as they desired (a test drive was not possible due to time constraints). Two private sellers were hired for a full day and sold cars to a total of 5 buyers each. The professional seller, who had 4 sales sessions, was not paid for participation in the evaluation, as she works for a car dealer, which is a partner in the research project. Thus, the evaluation was conducted with 14 buyers. Each of the sales sessions in both scenarios lasted for 90 minutes. Buyers were hired for 90 minutes each (45 minutes car sale, 15 minutes survey, 30 minutes interview). Such an evaluation requires high effort, therefore, the researchers had to balance between keeping the evaluation manageable and larger number of evaluation participants. Another study was conducted to investigate what overall

impact the cardossier has on the used car market from a macro-level perspective, where a larger number of participants (50) were involved (Bauer, Zavolokina, and Schwabe 2019). The study at hand, however, focuses on a micro-level perspective of the end users.

Each buyer was taken through three subsequent sale conversations with the sellers. In total, 52 sales conversations were conducted. In the first sale, the buyer and seller were not assisted by any IT device. This sale conversation is called "Traditional". This sale was considered as a point of reference for examining effect of a blockchain-based application on asymmetry of information and trust in general. In the second sale, both the buyer and seller were assisted by the Lite prototype - the prototype that offered only basic information elements (basic information about the car and a timeline of events), which might be stored in a system without additional elements like evaluations and the seller's reputation. This prototype was created to achieve the first objective of this study. The buyer and seller were asked to start the application on their phones by navigating to a website. They could look at the prototype for as long as they wanted (as if they were preparing for the meeting beforehand at home) and, once ready, they could start the sale conversation. Finally, in the third sale, the buyer and seller were assisted by the Complete Prototype, which included all design components. This prototype was created to achieve the second objective of this study. Again, the buyer and seller were asked to start the prototype and read through it before the sale. Table 2 summarizes which design components were included in the Lite and Complete prototypes. While carrying out the sales in a random order would have been preferable, this was not feasible due to the fact that information about car quality and reputation were "sticky": Once a buyer or seller read them in the Complete Prototype, he would not forget them, and it would affect the subsequent conversations. This important limitation could be avoided by increasing the sample size (and the combined randomization) or switching to between-subject design of the experimental setting.

Design components	**Included in Lite**	**Included in Complete**
(1) Basic information about the car and its condition	X	X
(2) Car timeline: relevant car-related events (registration, insurance, accident records, mileage records, etc.) and their sources	X	X
(3) Evaluation of car quality from an expert or other potential buyer		X

(4) Articles (in the press or industrial reports) written about the usage of the specific car model		X
(5) Cost prediction and life expectancy		X
(6) Seller's personal data as well as reviews from previous car sales		X

Table 2 Inclusion of design components in Lite and Complete prototypes

The experiments were conducted over three days in July 2018 (in total, 14 buyers, two private sellers, and one professional seller participated in the experiments). The setting (location, tasks) was kept as similar as possible between evaluations (with the difference that the professional sale took place in an underground car park). The settings are shown in Figure 8, where buyers and sellers are completing sales in front of the cars used in the study.

Figure 8 Photos from three days of experiments

After each of the sales sessions (traditional, Lite and Complete as described above), the buyers received a survey to complete. The survey consisted of questions about the buyer's knowledge of the car and its quality (to capture knowledge gained or lost in the sessions; based on the statements that were designed for and tested in the study, as no useful metrics were found in the literature), the buyer's trust in the seller (by measuring the perceived ability, benevolence and integrity based on (Fuller et al. 2007)) and the perceived trustworthiness of the overall sales process (based on (Söllner 2014)). The used questions were always measured on a 7-point Likert scale (from 1 being "I strongly disagree" to 7 being "I strongly agree"). The survey questions used in the evaluation can be found online[3]. The presented quantitative results shown below were calculated for N=10 buyers, involved in private sales only. The four professional sales are excluded from these results, as we believe that the professional sales differ significantly from private ones in respect to the trustworthiness of the seller and the overall sales process, and,

[3] https://docs.google.com/spreadsheets/d/1Lh0AQ53aWcI4cxC93zBdfAgCN6UNxasmj-mjOunwpyg/

therefore, should be separated. Furthermore, four professional sales cannot provide any significant result as the number of sessions is not large enough.

Qualitative results were obtained by conducting and analysing semi-structured interviews (Wengraf 2001) with each of the buyers, which took place directly after all three sessions were finished. Qualitative results include interviews with all 14 participating buyers (the interviewed buyers are further referred as K1 – K14). The interview guide contained questions about the following aspects: (1) trust, ability, benevolence and integrity of the seller and how they felt about the sale conversation; (2) car knowledge; (3) the IT artifact: which of the prototypes they would prefer in the next sale, parts they liked (or disliked) in the Lite and Complete prototypes, reputation features in the Complete Prototype and how they feel the cardossier can be improved. All interviews were transcribed, coded and analysed, with a focus on information asymmetry reduction and trust enhancement.

5.3 Evaluation results

In this section, the results of the evaluation are described in detail. We describe the results for reduction of information asymmetries and trust enhancement separately in the consequent sub-sections. We cover both the quantitative (surveys) and the qualitative (interviews) parts.

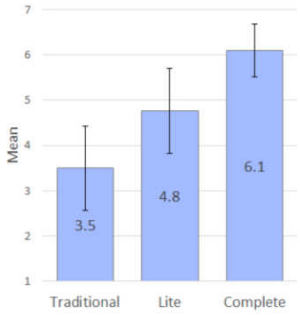

Figure 9 Knowledge about the car

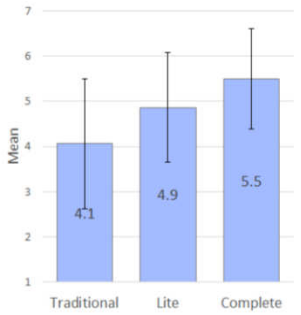

Figure 10 Buyer trust in the seller

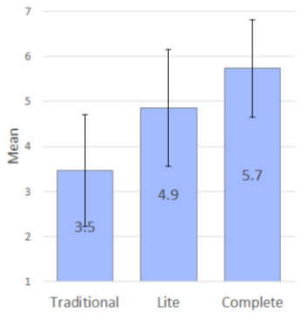

Figure 11 Buyer trust in the sales process

Reduction of information asymmetries

Figure 9 displays summary statistics that compare the means of the buyer's knowledge about the car for the Traditional, Lite and Complete settings. The introduction of the Lite prototype improved the measure, and the Complete Prototype setting further increased the mean. Altogether, the mean improved as follows: $3.5^{\text{Traditional}} \rightarrow 4.8^{\text{Lite}} \rightarrow 6.1^{\text{Complete}}$. It is clear that if the buyer used the Complete Prototype in the sale process, the buyer's

knowledge about the car being sold nearly doubles. Two-sided paired-samples t-tests were conducted to compare the means. There were significant changes ($p < 0.01$) from the means of Traditional (M.=3.47, S.D.=1.24) and Lite (M.=4.87, S.D.=1.30), and highly significant changes ($p < 0.001$) from Lite to Complete (M.=6.10, S.D.=1.07), as well as from Traditional to Complete, but not significant change from Traditional to Lite.

In the interviews, nearly all buyers remarked that they learned the most about the car during the Complete sessions, followed by the Lite sessions and Traditional sessions respectively. Upon being asked in which setting he was able to evaluate the car most effectively, K8 remarked: *"The sale conversations with the IT support were the best. I had information which was not talked about in the Traditional sale. I went around the car, looked at these things and asked about them."*

Other buyers also remarked that because of the advanced information elements (3 – 6) that were available in the last prototype, they were inspired to ask different and new questions about the car in comparison to the Traditional and Lite settings. They reported that these new types of questions and the resulting dialogue further increased their knowledge about the car. They also remarked that more information than "just the basics" (such as in the Lite prototype) must be available. Upon being asked to compare the knowledge gain of the Lite and Complete prototypes, K1 answered: *"Using the cardossier Lite, I did not have as much information in the beginning, and I had a bad impression upon realizing the high mileage of the car and not knowing more about it. I liked this a lot more in the cardossier Complete."*

Furthermore, the evaluation of the car (3) by third parties had a big impact on the reduction of information asymmetry for a lot of buyers. K3 even stated that out of all provided features, it was the most useful one for him: *"I learned the most [about the car] by reading the expert review in the third sale."* Other buyers, such as K6, also appreciated the reviews provided by non-purchasing buyers: *"So here I noticed, in the last one [the Complete Prototype], the comments that were in it from interested people who have already seen the car... these thumbs up and down, high mileage thumbs down, other things, like extras thumbs up. It also helped a lot to see the quality and condition. That jumped into my eye."*

Enhancement of trust

The trust of the buyer in the seller has been increased from both Traditional to Lite, and from Lite to Complete. On average, the mean improved as follows: $4.1^{\text{Traditional}} \rightarrow 4.9^{\text{Lite}} \rightarrow 5.5^{\text{Complete}}$. Figure 10 displays summary statistics that compare the means of the trust of buyers in the seller for the Traditional, Lite and Complete settings.

Two-sided paired-samples t-tests were again conducted to compare the means. There was a significant difference ($p < 0.05$) in the mean of the trust in the seller for Traditional (M.=4.07, S.D.=1.44) and Lite (M.=4.87, S.D.=1.21). There was also a significant difference ($p < 0.01$) in the mean of the trust in the seller for Traditional (M.=4.07, S.D.=1.44) and Complete (M.=5.50, S.D.=1.11). However, there was no significant difference in the mean of the trust in the seller for Lite (M.=4.87, S.D.=1.21) and Complete (M.=5.50, S.D.=1.11). These results suggest that both the Lite and Complete prototypes increase the trust of the buyer in the seller, but there is no significant increase from the Lite and Complete prototypes.

Figure 11 displays summary statistics of the buyer's trust in the overall sales process (respectively the IT artifacts). Summarized, the average mean improved as follows: $3.5^{\text{Traditional}} \rightarrow 4.9^{\text{Lite}} \rightarrow 5.7^{\text{Complete}}$. Two-sided paired-samples t-tests were again conducted to compare the means. There was a significant difference ($p < 0.05$) in the average means for Traditional (M.=3.47, S.D.=1.24) and Lite (M.=4.87, S.D.=1.30). Additionally, a highly significant difference ($p < 0.01$) in the average means for Lite and Complete (M.=5.73, S.D.=1.07) was found. Finally, the average means of Traditional and Complete also differed to a highly significant degree ($p < 0.01$).

In the interviews, many buyers reported that they felt a stronger sense of trust toward the seller during the Lite setting and even more so in the Complete setting (when compared to the Traditional setting). For instance, upon being asked in which conversation he had the most in trust in the seller, buyer K9 answered: *"Certainly in the ones with the cardossier."*

When comparing the trust of the buyer in the seller, the majority of buyers mentioned having higher trust in the Complete setting over the Lite setting. The reputation mechanism (6) in particular seemed to have a big impact on the buyer's trust. For instance, when asked where he had the most trust in the seller, K4 reported: *"Of course in the last one [cardossier Complete]. This is because there were reviews about the seller in the Complete Prototype, similar to on eBay. If he had good reviews, I also believed that he is a good seller. I did not have that with the Classic and the Lite."*

Another interesting phenomenon was noticed during the experiments. Buyers used the information in the prototypes to "fact-check" the seller, which affected their trust. For example, K5 notes: *"What I heavily noticed was that I had the most trust in the seller in the Complete setting. I was able to do a fact check, which increased my trust in him by a large margin." - K5.* He explains the phenomenon as follows: *"He had said two things, the date of first registration and the mileage, which I quickly looked up again because I thought he said the wrong*

thing. And then the app has given me the confidence again because he has said the right thing. For smaller things, I trusted and believed him, and for bigger things, I looked them up."

Thus, upon passing the "fact check" test, the trust between buyer and seller increases and upon failing, it decreases. Other buyers reported the same sequence of actions and thought processes. Another important result was that the Complete Prototype directly affected the seller's ability, benevolence and integrity. Several buyers mentioned that they felt these abilities of the seller were stronger in the Complete setting, compared to Lite or Traditional.

An important finding was identified in interviews with the buyers and sellers in both the requirements engineering phase and in the experiments: The information provided by the cardossier prototype is only useful if its correctness (meaning that information is verified to be accurate or truthful) is guaranteed. Otherwise, as some interviewees argued, its usefulness would be nullified, as such unreliable information is only as valuable as the word of a seller trying to sell them a 'lemon' (in other words, not useful at all). This point is further supported by the fact that some participants mentioned that they were "*unable to cope with the massive amount of information available at their fingertips*". It follows that in the used car market, more information is not always better.

As one way to enrich the quality of information, the experiment candidates noted that they liked the design of the timeline (2) in both prototypes. This was because each item in the timeline featured a small box showing that the information was verified (using a green check-mark) and where the information was collected (by providing the information source, e.g., the name of a garage where a service was conducted).

6 Discussion and Conclusions

The two research questions of our study were:

RQ1: How can the provision of car usage data in a blockchain platform reduce information asymmetries and enhance trust in the used car market?

RQ2: How can further relational data be included to reduce information asymmetries and enhance trust in the used car market?

The main source of information asymmetries has been identified to stem from the fact that the seller has knowledge about the car being sold that the buyer does not (Akerlof 1970). The findings show that both the Lite prototype and the Complete Prototype managed to increase the buyer's knowledge about the car by an impressive margin in both the private and professional sale experiment. In the private sale experiment, significant results were found.

In both experiments, the Complete Prototype managed to outperform the Lite prototype by roughly the same margin as the Lite prototype outperformed the Traditional setting. Thus, we can conclude that the cardossier prototype successfully reduces the information asymmetries between buyer and seller. These results imply that the buyer learned more about the car being sold and had better valuation success with both cardossier prototypes. As the Lite prototype focused on providing only basic information elements (e.g., date of first registration, mileage) about the car, this indicates that one way to reduce the information asymmetry is through providing basic information elements about the car, as the literature suggests (Ba and Pavlou 2002; Mishra et al. 1998). Based on the results, it follows that there should actually be more focus on the quality of the information than the quantity. For this, the authentication property of blockchain technology is helpful (Miscione et al. 2018). However, correctness of such data must be guaranteed (and backed by nodes, operating the system, or system designers) and properly communicated to the user to enable the positive outcome. In the case of the cardossier prototype, we added product-related information such as evaluations of the car from third parties (like experts), which provide additional validation of the existing raw data from the timeline. Additionally to validation, these evaluations help in making sense on the business level and help the end user, who lack experience in car sales, more accurately make his/her decision. This finding suggests that applications that utilize data from blockchain platforms still should include some third-party human actor that can reflect on quality of a product (in our case the car). With this, we can also conclude that trust in the IT artifact itself (Söllner et al. 2012) plays an important role not only as a mediator, but also as a trustee to build up initial trust in the system itself, and should be further explored in this context.

In our study, we also looked how product-related information, such as data analysis for costs prediction and life expectancy, may be reflected in the interface. Though probably not crucial for trust building, these elements have an important role for reduction of information asymmetries and offer a powerful mechanism for decision-making on purchase of a car. These elements close the gap in knowledge and expertise of an average car buyer, addressing the problems, mentioned by Zavolokina et al. (2019). Furthermore, in this study we show, how the requirements for a blockchain-based application in the used car market, proposed by Zavolokina et al. (2019), can be actually implemented in a prototype and, thus, evaluate their usefulness and limitations.

Furthermore, the fact that person-related data such as reputation data is stored in the system may hinder the participation of car owners, who may be unwilling to have negative (and sometimes untruthful) information about them stored. With this, the privacy issue should be considered as well, concerning what personal data should be

stored in the blockchain and how a car owner may retain control over this data. Furthermore, a question of reputation transferability (Kokkodis and Ipeirotis 2015) between platforms in the context of a car sale becomes even more relevant. A private seller is unlikely to sell many cars in a short period of time; therefore, his/her reputation cannot be based on a large number of transactions, but may be provided by other platforms (e.g., auction sites like eBay, or social media). To make this reputation transfer possible, blockchain technology may be beneficial due to its distributed and decentralized operation. These are the questions that should be further studied.

The Complete Prototype focused on providing advanced information elements and market transparency (such as interactive elements showing estimated costs; provision of car evaluations, featuring reviews by independent experts; and non-purchasing buyer ratings), as well as a reputation mechanism, and therewith managed to further improve the car knowledge of the buyers. This leads us to the conclusion that by adding such advanced information elements as well as a reputation system, we can further enrich the buyer's knowledge and thus reduce the information asymmetries, improving the situation in 'The Market for Lemons' (Akerlof 1970). Using the insights from the research at hand, we further study effects of the cardossier application on market transparency in the subsequent study (Bauer, Zavolokina, and Schwabe 2019). However, the interplay between the elements must be studied further: is market transparency together with a reputation mechanism stronger than these elements in isolation? And what role do they play in the trust relationships? This also brings us back to the question of what value blockchain technology creates. While prior literature focused on the value, blockchain technology generates to businesses (Bauer, Zavolokina, Leisibach, et al. 2019), and to markets (Bauer, Zavolokina, and Schwabe 2019), in our study we were able to examine the user perspective in a face-to-face used car sales scenario. In our study, we were able to focus more on the personal interaction between used car buyers and sellers, and their trust relationships. We can conclude that, firstly, it is not blockchain technology per se which brings value, but an application built on top of it. The technology itself, however, contributes to the availability and the trustworthiness of car-related data provided. While there may be other sources of car-related information, such as CarFax report or the ones provided by car manufacturers, they were not accessible in the context we examined (not because of the study design, but in general in the country, where the study was conducted; therefore, the participants of the study were also not familiar with them). However, from the user perspective, the trustworthiness and authentication property (Miscione et al. 2018), should be communicated to the user in a straight-forward way (for this, explanatory tools, such as FAQs, videos, are helpful). If this condition is fulfilled, the users appreciate authenticated data a lot. With this, we confirm that trust is the main value that blockchain technology creates

(Fleischmann and Ivens 2019), but this 'trustfulness' of data should be established not only on the technical level, and on the user level (e.g. by communicating). What other factors contribute to and make blockchain-based data trusted should be studied further.

The findings show that both the Lite and Complete prototypes managed to increase the buyer's trust in the seller. This effect was significant for the Lite setting and highly significant for the Complete round. Interestingly, there was no significant change in the buyer's trust in the seller from the Lite to the Complete setting. This implies that the trust relationships were already improved by the reduction of information asymmetries (making the basic data and the events, provided by an external party in the cardossier, available in the digital form). The interviews conducted following the experiments can help explain this result. Several buyers used the information in the prototype to "fact-check" the seller. In a first step, they looked for and read specific information, such as the car's mileage, in the prototype. Then, in the sale conversation itself, they tested the seller by "fact-checking". Using the example of the mileage, they asked the seller what the car's mileage was. Several buyers mentioned in the interviews that if the mileage given by the seller matched what they read in the prototype, they would see him as more trustworthy. Similarly, if the seller gave a different answer, they would lose trust in the seller. However, results suggest that the additional information elements improve the overall purchase experience of buyers.

To summarize, this study contributes to the literature in several ways. First, it contributes to the stream of literature on solutions helping to resolve information asymmetries and enhance trust in inter-personal relationships by introducing a design of such application and discussing its usage. Results of this study can be transferred to markets with similar conditions: i.e. where history and quality of a physical good is important and, if hidden, cause mistrust between buyers and sellers. A good example of such can be real estate market. Second, it contributes to the literature on blockchain-based applications, making a conclusion that, from end users' perspective, 'raw' data from a blockchain system does not suffice to resolve the mentioned problems, additional support for sense-making is needed. We show, how this may be reflected in an application design.

7 Limitations

It is important to recognize the following limitations. Firstly, the limitation resulting from the use of the main DSRM approach. Since the goal is to find comprehensive solutions to both the information asymmetry and trust problems, the results cannot be attributed to isolated, simple factors such as colors or pictures used in the prototypes. Further limitations also result from the evaluation itself. One limitation was that the experiment setting

was near-realistic. This setting was selected purposely, but cannot be compared to laboratory conditions, where most factors can be controlled easily. Due to the complex nature of a car sale, this was the best available option. Another limitation was that the test participants (with the exception of the professional car seller) were all hired and received monetary compensation for acting out a scenario in which they were tasked to buy a car. Due to the "sticky" nature of information, the order in which the three sale conversations were conducted was always the same. This could lead to buyers changing behavior, as well as remembering information from previous conversations and building more trust through extended exposure to the seller. Furthermore, we evaluated the proposed design component as a whole; the separation existed only between the Lite and Complete prototypes. Therefore, it is hard to isolate the components that had the greatest impact on the results. We also recognize that the measures used were focused more on the perceived and subjective feelings of the participants, as they were asked in the survey, rather than any other possible evaluation strategies to capture gained knowledge or experienced trust. Finally, the sample size for both experiments is small, so the offered results have some limitations in generalizability.

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